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TECHNICAL REPORT
NATICK/TR-76/005

WASTE DISPOSAL UNIT; DESIGN, FABRICATION and TEST

York Industries Inc.
Emigsville, PA 17318

February 1976

Food Engineering Laboratory
FEL-39

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Natick/TR-78/005 ✓
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER: (9) Technical rept.
4. TITLE (and Subtitle): (6) WASTE DISPOSAL UNIT DESIGN, FABRICATION AND TEST
5. TYPE OF REPORT & PERIOD COVERED: April 1974 to February 1976
6. PERFORMING ORG. REPORT NUMBER: FEL #69
7. AUTHOR(s): (10) Peter J. Hoet
8. CONTRACT OR GRANT NUMBER(s): (15) DAAK03-74-C-0106
9. PERFORMING ORGANIZATION NAME AND ADDRESS: York Industries, Inc. ✓ Emigsville, PA 17318
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (16) 1T762724AH99 6.2 CA-020BG
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Natick Research & Development Command DRXNM-WS Natick, MA 01760
12. REPORT DATE: (11) February 1976
13. NUMBER OF PAGES: 53
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (12) 56 p.
15. SECURITY CLASS. (of this report): UNCLASSIFIED
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report): Approved for public release; distribution unlimited
(18) NATICK, FEL
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
(19) TR-78/005, 69
18. SUPPLEMENTARY NOTES

DDC RECEIVED MAR 20 1978 B

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

WASTE DISPOSAL	SANITATION	CONTAINERS
WASTE DISPOSAL SYSTEM	WASTE HANDLING	COMPACTORS
WASTE (S)	MESS HALLS	
REFUSE	KITCHENS	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this effort was to provide a waste disposal unit which would improve waste handling in the Garrison Dining Facility encompassing both the waste generated in the kitchen as well as the tray waste from the dining area. The primary objective was to improve appearance and sanitation of the facility and generate a product which could be disposed of more conveniently. To accomplish this, a heavy duty horizontal compactor was designed and fabricated to essentially reduce the volume of total waste deposited in dumpsters or containers or picked up by contractors. The unit compacts in its chamber,

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and upon reaching a given size, the compacted slug is ejected into a specially designed castered container or dumpster. The compacted waste in the container is then treated with ozone to deodorize it.

SUMMARY.

This report presents the results of all work performed in the design, fabrication, assembly and test of a high face pressure, bulkhead type waste compacting system.

The purpose of this project was to develop a mess hall waste handling system that would:

- Process all waste generated in the kitchen and the mess hall, including packaging material (glass, crates, metal containers, cardboard, etc.) animal and vegetable waste, paper, plastic, etc.
- Process this waste in a sanitary and efficient manner, at the rate of 600 lbs. per hour.
- Improve upon the current methods of scullery and mess hall handling.
- Improve appearance of scullery and mess hall.
- Reduce the volume of generated waste to improve subsequent disposal. Minimum volume reduction required is 4 : 1.

The system developed under this contract consists of a compacting unit and one or more mating, castered containers, that receive the compacted waste slugs without manual handling. The containers are designed to interface with rear-loading packer body garbage trucks, which pick up the container and automatically transfer the waste to the truck.

Direct human contact with the waste ceases when the waste is deposited in the compactor hopper.

Vermin, insect and odors are controlled by the use of an ozone generating purifying unit. The low concentration ozone is piped into the container where it destroys the odor causing bacteria which attract vermin and insects.

Volume reduction of 8 : 1 has been obtained by using a high compaction force (300 lbs./sq. inch; 46,000 lbs. total ram force). In addition, this high force is used to squeeze out liquids. Integral drain pans collect slurry and liquids for disposal into floor drains.

The unit is designed to withstand complete repeated washdowns. Side panels are readily (no tooling required) removable, facilitating maintenance and cleaning.

The unit is designed for both outdoor and indoor usage and will operate in temperature range from -10 degrees to 125 degrees F.

Operation of the unit can be either manual or automatic. Safety interlocks are incorporated to eliminate personnel and equipment hazards. Safety devices are designed to prevent tampering.

The acceptance test showed that the unit efficiently met and exceeded the design criteria. Volume reduction of over 8:1 exceeded the minimum 4:1 requirement, and liquids and slurry were eliminated from the waste. A dense dry mass was created by the high compaction forces. The equipment functioned without breakdown and accepted and processed the prescribed combination of, and individual types of waste.

PREFACE

Compaction is a technique which could lead to substantial improvements and labor savings in waste handling in Military Dining Facilities. This effort represents an attempt to compact most kitchen and dining hall waste with a relatively high liquid content.

This work was performed under Project No. 1T762724AH99, Food Technology, Tech Area AH99C, Food Service Technology, Technical Effort AH99CA, Studies in Garrison and Field Food Service Equipment, Requirement No. USA 3-6, Design and Fabrication of Waste Disposal Unit. Messrs. J. Nibi and L. Harlow were the Project Officer and Alternate Project Officer, respectively, for the U.S. Army Natick Res & Dev Command formerly U.S. Army Natick Laboratories.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TECHNICAL REPORT

Current Waste Handling Practices

In general, mess hall waste and kitchen refuse are currently collected in 32 gallon cans. Full cans are carried outside and dumped into either larger containers which are emptied by outside garbage contractors, or taken to on-base incinerators. The repeated handling of cans, carts, dollies, etc., as well as the continuously required washdowns of cans and scullery area to maintain sanitary conditions are wasteful of manpower and materials.

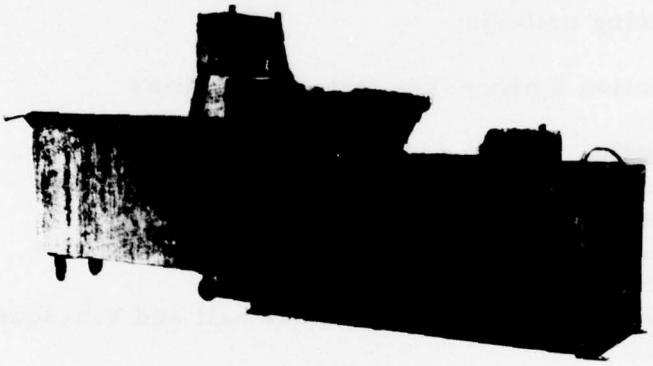


FIG. 1 COMPACTOR/CONTAINER ASSEMBLY

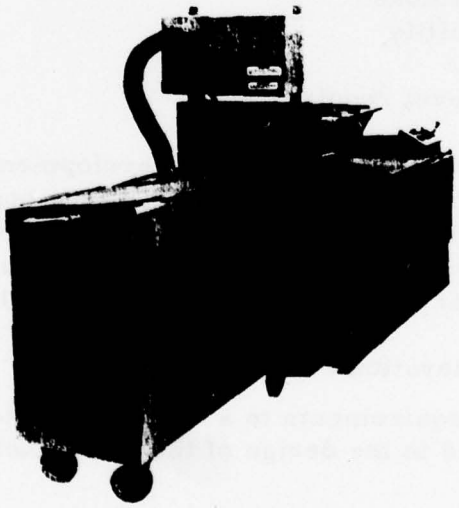


FIG. 2 COMPACTOR/CONTAINER ASSEMBLY

System Selection

The improvement of waste handling can be achieved by a variety of processes, used either singly or in combination. Among the methods available and considered are:

a) Incineration
b) Grinding or shredding
c) Pulping
d) Dehydrating
e) Compaction - all varieties

During the proposal phase of this program these methods were evaluated against the following criteria:

1 - Volume reduction & processing rate capabilities
2 - Ease of use
3 - Ease of operation - Personnel skill level requirements.
4 - Operational manpower requirements
5 - Operational safety
6 - Indoor/outdoor usage
7 - Set-up requirements
8 - Interfacing with scullery/kitchen/mess hall and subsequent handling of reduced waste
9 - Energy usage
10 - Equipment simplicity and compactness
11 - Spares requirements
12 - Pollution - Noise, smoke
13 - Sanitation & Cleanability
14 - Ease of Maintenance
15 - Maintenance skill level requirements

Evaluation of these factors resulted in the development of a waste handling system consisting of a high pressure bulkhead type compactor and castered containers which mate with the compactor and automatically receive compacted waste slugs. The containers are so designed as to interface with rear loading garbage packer trucks which mechanically unload the container.

Selected System Considerations

In reducing the basic requirements to a workable system, additional parameters were considered in the design of the unit. Included were the following:

- Volume of thru-put
- Actual reduction

- Force requirements
- Container size
- Number of containers
- Access to compactor
- Method of input
- Location of compactor

Volume of thru-put.

In order to determine the volume of thru-put it was required to develop values for the densities of the various elements that make-up the input waste. The mix of these elements were provided by Natick Laboratories in the statement of work and are reflected in second and third column of Table I. Using standard densities for the various components of the waste mix, input volume and overall densities were developed. Input volume, as shown, would be approximately 192 cubic feet per hour.

Actual Reduction

Compaction ratios can vary from 1:1 for wood to over 10:1 for plastic or paper cups, containers and certain cans.

Given the mix shown in Table I an average theoretical volume reduction of 8:1 is shown.

As far as weight output is concerned, the table makes no allowance for draining off liquids that are squeezed out in the compaction process. If it is assumed that 30% of liquids in the item I category is eliminated, the output is reduced by .7(300)(.3) = 63 lbs. to approximately 540 lbs. per hour. In addition, the compacted output volume is reduced somewhat.

Force Requirements

The selection of a suitable ram size and force was based upon some preliminary testing done at our facility and on work done by others. It was determined that the force required to buckle a No. 10 can is about 2,300 lbs. Other factors coming into play are the forces required to shear cans, wood, strapping and other items protruding from the charging chamber into the hopper.

The selection of a 13 1/2 inch ram and 300 psi ram face pressure was based upon the above, as well as practical consideration. Size of charging chamber, which should be as large as possible in order to accept whole small boxes, cans, etc., was traded off against the largest practical motor size to develop the desired ram pressure. Theoretical indications were that this size ram operating with this pressure could produce an average output density of 50 lbs. per cubic foot; infering an overall compaction ratio of 16:1 (see Table I).

TABLE I

Analysis of Through-Put

ITEM	DESCRIPTION	LBS/HR	AVG LOOSE DENSITY LBS/CU.FT	CU.FT/HR	AVG COMPACTION RATIO	OUTPUT CU.FT/HR
1	Animal & Vegetable, edible and non-edible 70% liquid	300	38.0	7.9	4:1	2.0
2	Paper, paperboard, napkins and fiberboard	100	0.8	125.0	10:1	12.5
3	Metal cans, 28 gauge and lighter	50	5.25	9.5	7:1	1.3
4	Wood and small crates	50	3.0	16.7	4:1	4.2
5	Glass jars and bottles	75	15.0	5.0	8:1	0.6
6	Plastics, cups, wrappings	20	0.8	25.0	10:1	2.5
7	Other	5	2.0	2.5	4:1	0.6
	TOTALS	600	3.13	191.6	8:1	23.7

Container Size.

The following considerations were evaluated determining container size.
1) The maximum weight one person could handle in a castered container assuming 6 inch diameter wheels.
2) Maximum container size that can be used indoors (door passage widths).
3) Processing rate and rate of container changes.

Based upon actual tests performed with the selected containers it was found that weight and size (doorways) are limiting factors. A one cubic yard container, loaded with 1,500 lbs. is about the limit one man can handle on a macadam (parking lot type) surface.

This weight maximum would require a container interchange every 2 1/2 hours, at the desired thruput rate of 600 lbs. per hour. However, with the average compaction ratio of 8:1 assumed in Table I the container (27 cubic feet) will fill up in slightly over one hour (last column Table I). Theoretical indications were that a higher overall compaction ratio thru 8:1 could be obtained. This would result in a smaller volume of compacted waste than the 23.7 cft. indicated in Table I, increasing the time between container exchange as dictated by volume considerations.

Container exchange intervals dictated by volume limitations would approach the interval based upon weight limitation.

Based upon the above a one-cubic yard container was selected as being the optimum size.

Number of Containers.

The number of containers required with each compactor is determined by two factors:
1) Processing rate required at any particular location.
2) Rate of pick-up by local garbage haulers.

Access to Compactor.

The last three items, Access to Compactor, Method of Input, Location of Compactor, listed initially in this section are related. Figures 3, 4 and 5 show alternate arrangements for compactor locations and loading methods. The unit provided is shown in figures 1 and 2.

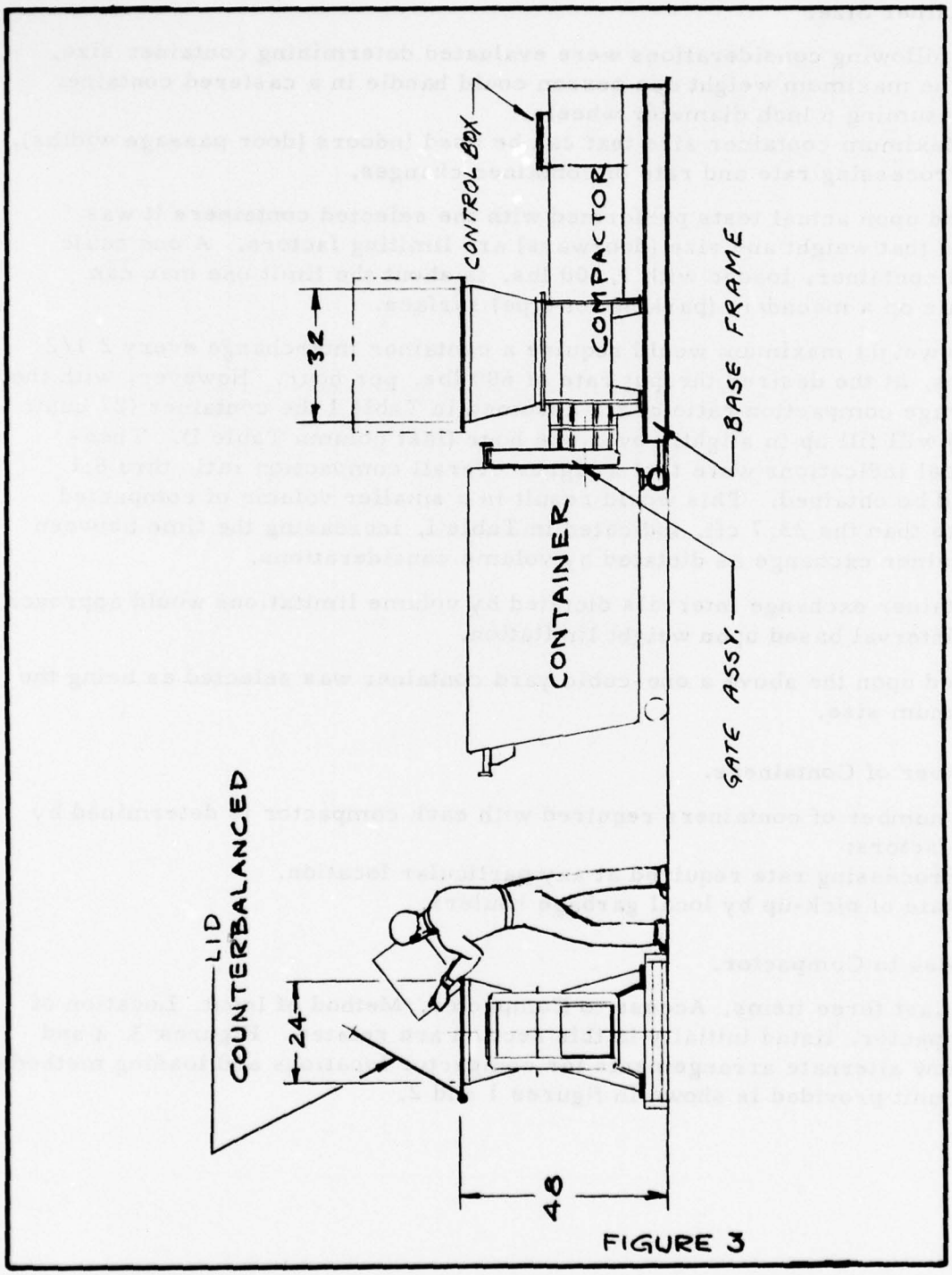

CONTROL BOX
COMPACTOR
32
BASE FRAME
CONTAINER
GATE ASSY.
LID
COUNTERBALANCED
24
48

FIGURE 3

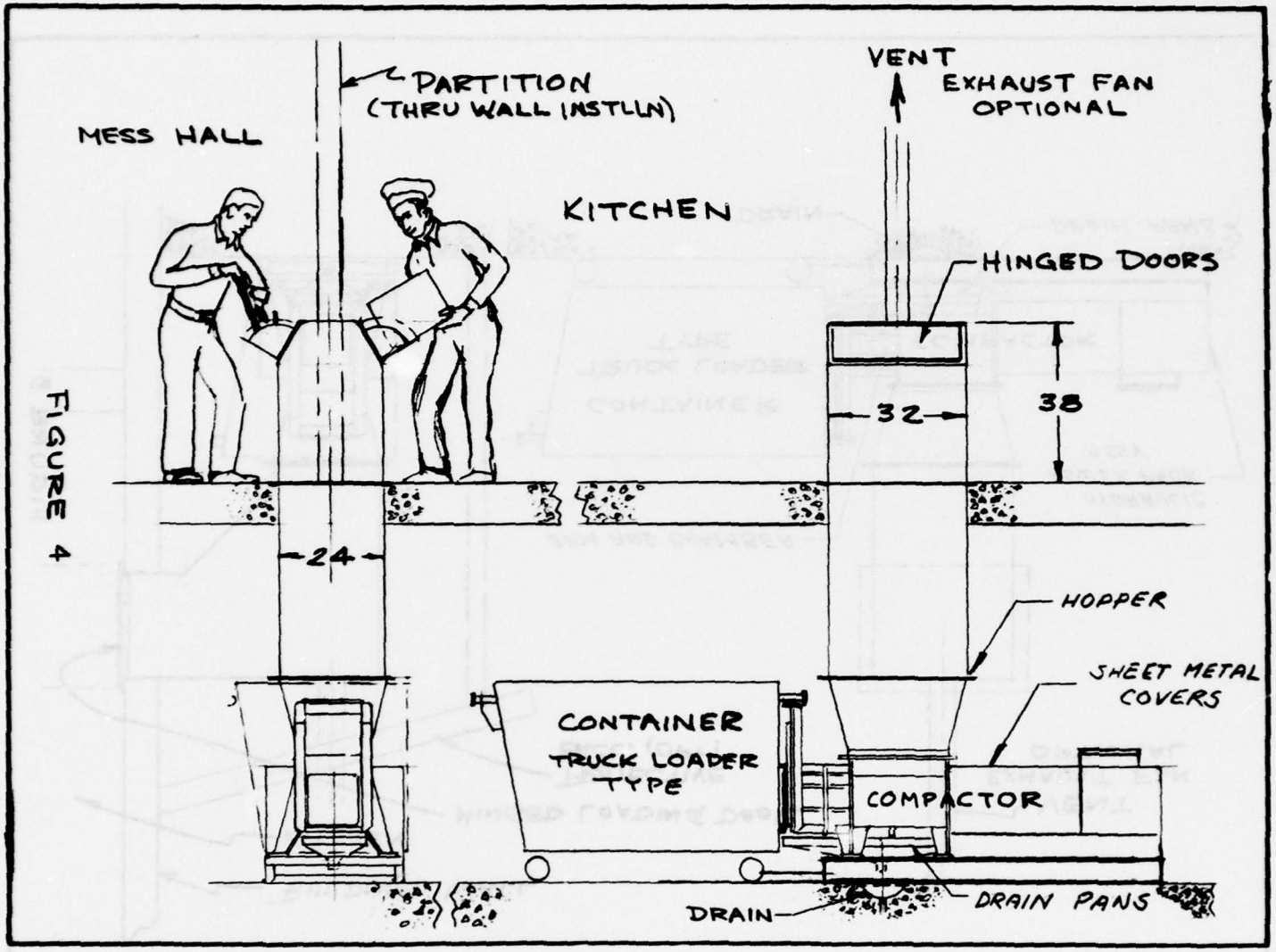

MESS HALL
PARTITION
(THRU WALL INSTLLN)
VENT
EXHAUST FAN
OPTIONAL
KITCHEN
HINGED DOORS
32
38
24
HOPPER
SHEET METAL
COVERS
CONTAINER
TRUCK LOADER
TYPE
COMPACTOR
DRAIN
DRAIN PANS

FIGURE 4

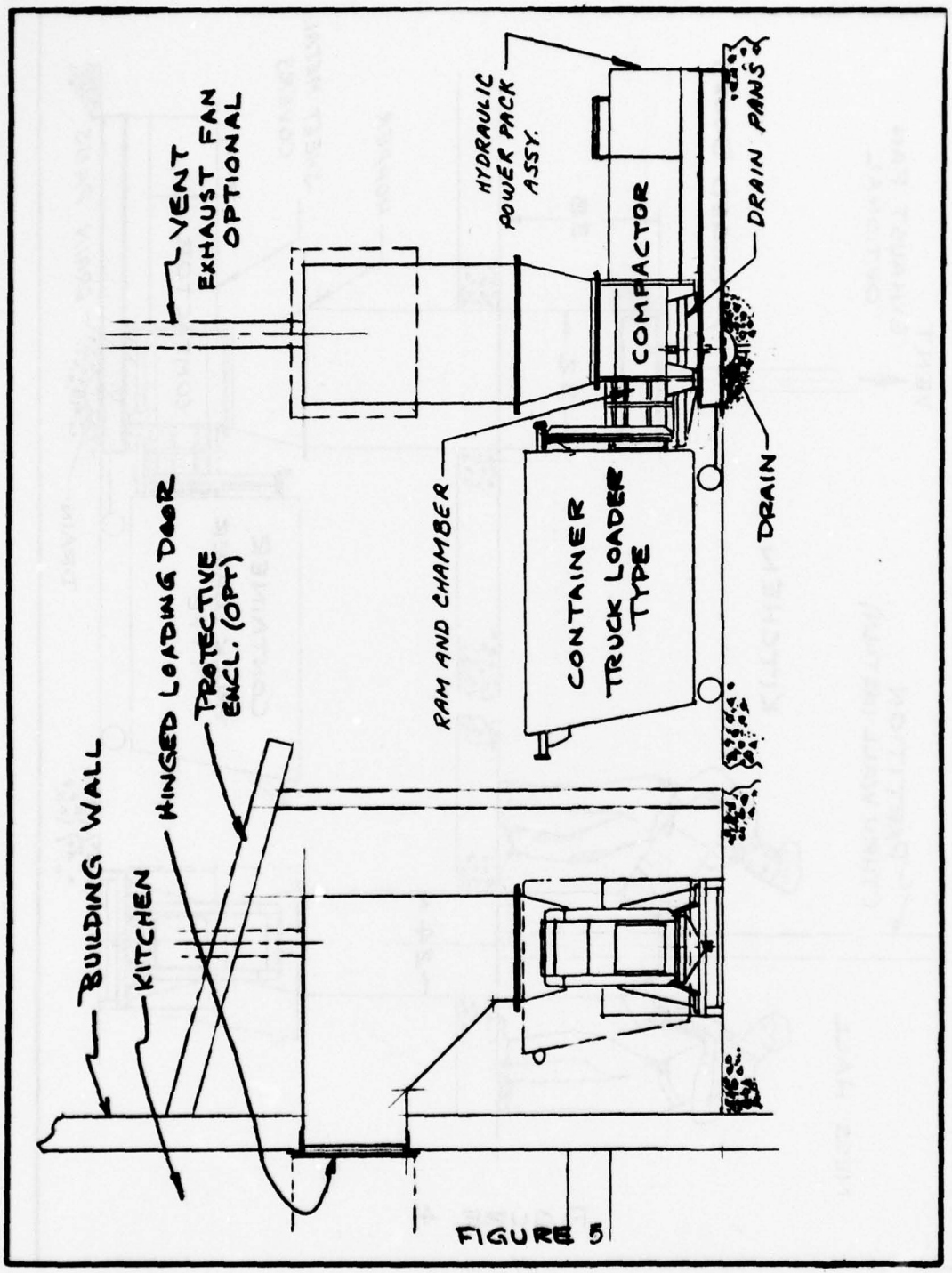

VENT
EXHAUST FAN
OPTIONAL
HYDRAULIC
POWER PACK
ASSY.
DRAIN PANS
COMPACTOR
RAM AND CHAMBER
CONTAINER
TRUCK LOADER
TYPE
DRAIN
BUILDING WALL
KITCHEN
HINGED LOADING DOOR
PROTECTIVE
ENCL. (OPT.)

FIGURE 5

Detailed System Description.

The waste handling system consists of two components, the compactor and the container.

The compactor is 95 1/2" long by 37 1/2 inches wide by 51 inches high, measured to the rim of the hopper.

The compactor consists of the following main components shown in Figs 3,4 & 5

- Base frame
- Compaction and receiving chamber
- Hopper and lid
- Compaction Ram & hydraulic actuator
- Gate assembly
- Hydraulic power pack assembly
- Control box
- Sheet metal covers
- Drain pans

The base frame is constructed from structural tubing elements. All tubular components are closed excluding entry of foreign material. All components are laid out to facilitate washdown.

The compaction and receiving chamber weldment, the hopper and the compaction ram are supported on the base by four legs. The hydraulic power pack assembly is packaged below the retracted ram and the hydraulic reservoir is located below the compaction chamber. The control box housing the relays, timers, etc. is located on the side, allowing for access when required. The pushbutton panel is located on top of the control panel at a level convenient for operation.

The gate assembly is mounted in front of the compaction chamber. It consists of a hydraulically raised/lowered bulkhead plate, interlocking limit switches, the container interfacing snout and appropriate guards.

Drain pans are mounted below the compaction chamber and at a lower level, below the gate. The upper drain pan extends to the rear beyond the compaction chamber in order to receive any liquids or slurry that is wiped back by the retracting ram. The upper drain pan discharges into the lower drain pan. The lower drain pan in turn has a nipple for connection to a floor drain. The lower drain pan is configured to catch liquids that are squeezed out by the bulkhead door.

The container consists of a one cubic yard sheet metal box. Mobility is achieved by means of roller bearing casters, two rigid and two swivel, with 6-inch diameter wheels. On one side, the container is equipped with a covered receptacle. The cover is hinged downward. The receptacle mates with the snout on the container. A rigid connection between container and compactor is obtained by latching components mounted on the mating parts.

Two hinged lids cover the container. The lid closest to the compactor is equipped with the input flange for mating with the deodorizer flexible hose. Lids have been rigidized to avoid distortion in use. The container is designed with features for interfacing with rear loading packer trucks.

Tests have shown that a container loaded with 1,600 lbs. can be moved by one man on a macadam, slightly sloping surface. Movement on a smooth floor is considerably easier.

Detailed Theory of Operation.

The unit will function in either an automatic or manual cycle mode.

In the automatic mode, selected by the appropriate mode selector switch, the unit will automatically perform multiple compaction cycles and ejection of a full size slug. The only requirement is that the operator initiates the start button each time the hopper has been charged. Also the operator has to initiate the ejection cycle.

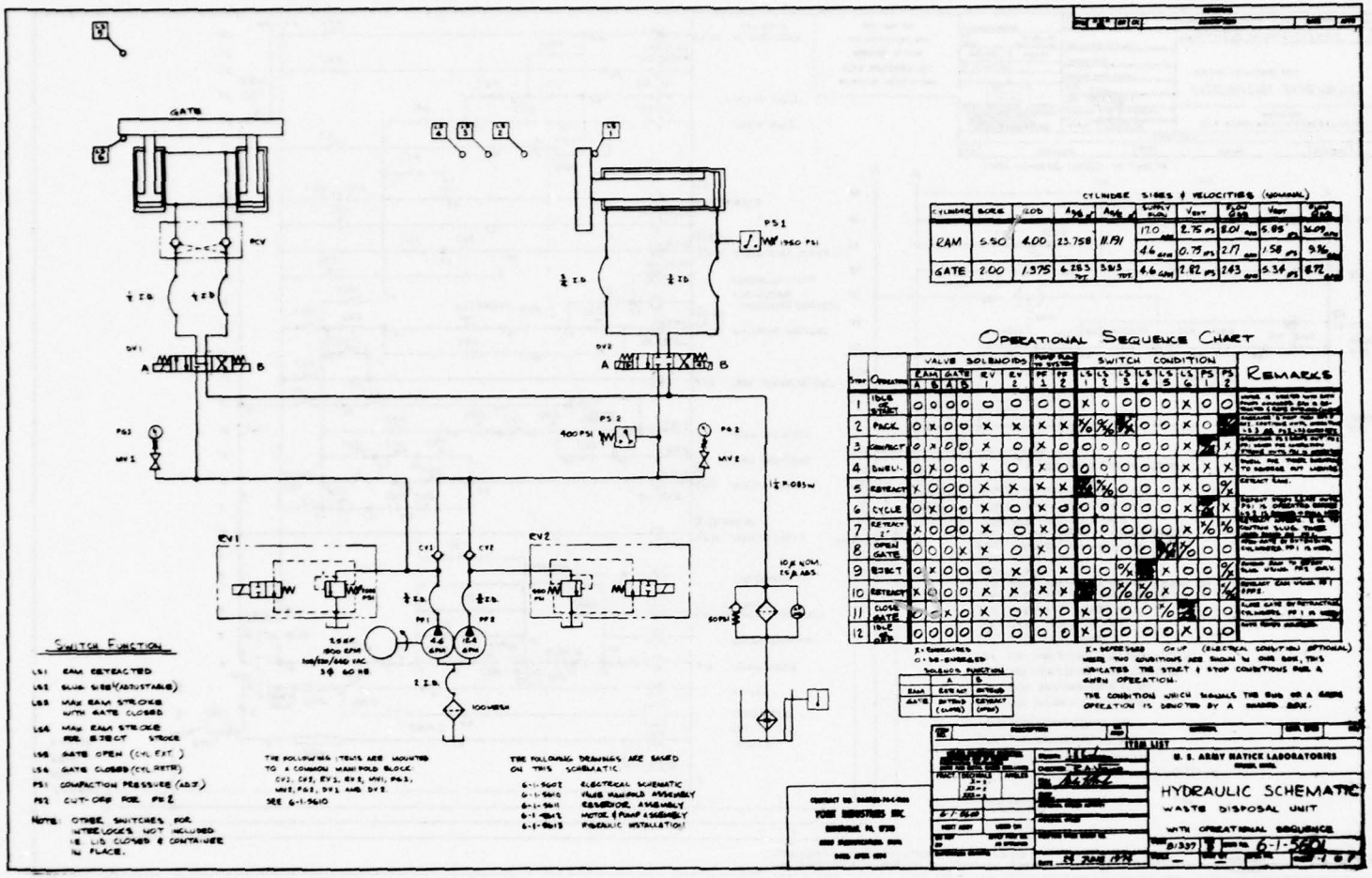
To facilitate comprehension of the detailed description, it is suggested that the reader consults the Hydraulic Schematic (dwg. 6-1-5601) and Electrical Schematic (6-1-5602) which have been included in this report.

To charge the hopper, the operator releases the hopper latch and opens the lid. The lid is counterbalanced to remain open in any desired position. A limit switch, covered to prevent tampering, is incorporated in the lid hinge area. This switch LS7 drawing 6-1-5602 is a safety interlock. In the open lid position all machine functions are interrupted.

After filling the hopper, the lid is closed and the "start" button is pushed. This starts the motor, and after a delay the ram will travel forward pushing the waste into the compaction chamber. (See step 1, Operational Sequence Chart on drawing 6-1-5601). The delay is built in to allow motor to come up to speed.

The ram will initially move at high speed, since little force is required in the initial part of the stroke. This is accomplished by using the outputs of both pumps. When the ram reaches the end of the charging chamber, it will shear off anything protruding upward into the hopper area. This shearing is accomplished by hardened teeth on the upper edge of the ram.

A hardened counter shear blade is mounted on the upper forward edge of the charging chamber. Depending upon the shear force required, the ram speed may change to low. If the force required exceeds the setting of pressure switch 2 (PS2; 6-1-5601) the signal from this switch will activate the solenoid of relief valve RV2, unloading pump PF2. Note - should failure occur in PS2, unloading of pump PF2 will occur via the spring loaded relief valve in the RV2 package. The ram will continue its travel



CYLINDER SIZES & VELOCITIES (NOMINAL)

CYLINDER	BORE	ROD	A_{eff}	A_{eff}	SUPPLY FLOW	V_{EXT}	FLOW GPM	V_{RET}	FLOW GPM
RAM	5.50	4.00	23.758	11 PSI	17.0 LPM	2.75 IPS	8.01 LPM	5.85 IPS	16.09 LPM
					4.6 GPM	0.75 IPS	2.17 LPM	1.58 IPS	9.96 LPM
GATE	2.00	1.375	4.283 IN²	3.13 IN²	4.6 GPM	7.82 IPS	2.43 LPM	5.34 IPS	8.72 LPM

OPERATIONAL SEQUENCE CHART

STEP	OPERATION	VALVE SOLENOIDS RAM A	RAM B	GATE A	GATE B	EV 1	EV 2	PUMP FLOW TO SYSTEM PP 1	PP 2	SWITCH CONDITION LS 1	LS 2	LS 3	LS 4	LS 5	LS 6	PS 1	PS 2	REMARKS
1	IDLE OR EJECT	O	O	O	O	O	O	O	O	X	O	O	O	O	X	O	O	
2	PACK	O	X	O	O	X	X	X	X	½	½	½	O	O	X	O	½	
3	COMPACT	O	X	O	O	X	O	X	O	O	O	O	O	O	X	½	X	
4	DWELL	O	X	O	O	X	O	X	O	O	O	O	O	O	X	X	X	
5	RETRACT	X	O	O	O	X	X	X	X	½	½	O	O	O	X	O	½	
6	CYCLE	O	X	O	O	X	O	X	O	O	O	O	O	O	X	½	X	
7	RETRACT	X	O	O	O	X	O	X	O	O	O	O	O	O	X	½	½	
8	OPEN GATE	O	O	O	X	X	O	X	O	O	O	O	O	½	½	O	O	
9	EJECT	O	X	O	O	O	X	O	X	O	O	½	½	X	O	O	½	
10	RETRACT	X	O	O	O	X	X	X	X	½	O	½	½	X	O	O	½	
11	CLOSE GATE	O	O	X	O	X	O	X	O	X	O	O	O	½	½	O	O	
12	IDLE OR EJECT	O	O	O	O	O	O	O	O	X	O	O	O	O	X	O	O	

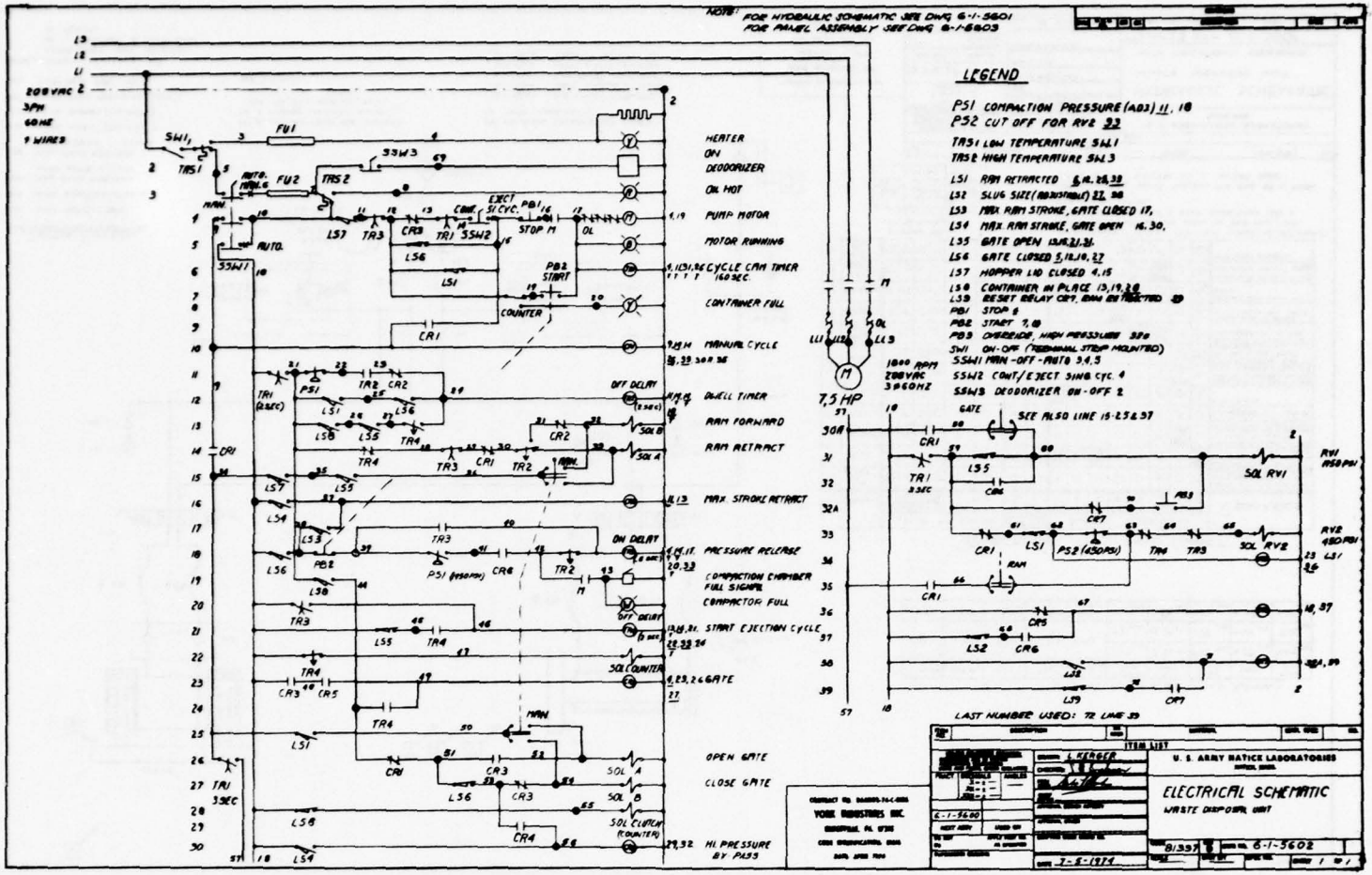
X = ENERGIZED
O = DE-ENERGIZED

SOLENOID FUNCTION

	A	B
RAM	EXTEND (PACK)	RETRACT (OPEN)
GATE	RETRACT (CLOSE)	EXTEND (OPEN)

X = REPRESENTS GROUP (ELECTRICAL CONDITION) OPTIONAL WHERE TWO CONDITIONS ARE SHOWN IN ONE BOX, THIS INDICATES THE START & STOP CONDITIONS FOR A GIVEN OPERATION.

THE CONDITION WHICH SIGNALS THE END OF A GIVEN OPERATION IS DENOTED BY A SHADED BOX.


NOTE: FOR HYDRAULIC SCHEMATIC SEE DWG 6-1-5601
FOR PANEL ASSEMBLY SEE DWG 6-1-5603
LEGEND
PS1 COMPACTION PRESSURE (ADJ) 11, 18
PS2 CUT OFF FOR RV2 33
TAS1 LOW TEMPERATURE SW.1
TAS2 HIGH TEMPERATURE SW.3
LS1 RAM RETRACTED 6 IN. 28, 38
LS2 SLUG SIZE (ADJUSTABLE) 27, 36
LS3 MAX RAM STROKE, GATE CLOSED 17,
LS4 MAX RAM STROKE, GATE OPEN 16, 30,
LS5 GATE OPEN 13, 18, 21, 31,
LS6 GATE CLOSED 5, 18, 10, 27
LS7 HOPPER LID CLOSED 4, 15
LS8 CONTAINER IN PLACE 13, 19, 26
LS9 RESET RELAY CR9, RAM RETRACTED 39
PB1 STOP 6
PB2 START 7, 18
PB3 OVERRIDE, HIGH PRESSURE 32a
SW1 ON-OFF (TERMINAL STRIP MOUNTED)
SSW1 MAN-OFF-AUTO 3,4,5
SSW2 CONT/EJECT SING CYC 4
SSW3 DEODORIZER ON-OFF 2
1800 RPM
208 VAC
3 Ø 60 HZ
7.5 HP
208 VAC 3PH 60HZ 3 WIRES
HEATER
ON
DEODORIZER
OIL HOT
PUMP MOTOR
MOTOR RUNNING
CYCLE CAM TIMER
160 SEC.
CONTAINER FULL
MANUAL CYCLE
DWELL TIMER
RAM FORWARD
RAM RETRACT
MAX. STROKE RETRACT
PRESSURE RELEASE
COMPACTION CHAMBER FULL SIGNAL
COMPACTOR FULL
START EJECTION CYCLE
OPEN GATE
CLOSE GATE
HI PRESSURE BY PASS
SEE ALSO LINE 15-25 & 37
LAST NUMBER USED: 72 LINE 39
ITEM LIST
U. S. ARMY NATICK LABORATORIES
ELECTRICAL SCHEMATIC
WASTE DISPOSAL UNIT
6-1-5602
J. KRUGER
7-5-1974

at a lower speed, but with full ram force available (output from pump PF1 only). After shearing, if the force requirement reduces to a pressure below 450 psi, ram travel will resume full speed. The ram will travel to within a few inches of the bulkhead gate.

The travel limit is determined by the location of limit switch 3. This switch, physically mounted above one ram/support beam, and schematically shown on 6-1-5601, is located such that the ram teeth do not contact the closed bulkhead door. A welded stop prevents this switch from being adjusted beyond the safe point.

In the first stroke of the ram, it is not likely that full ram pressure is always obtained. Upon activation of LS3, the ram will fully retract, at full speed, and any waste still in the hopper will fall into the charging area. At full retraction LS1 is tripped, which will initiate, automatically, the next forward ram stroke. The cycling will continue until hopper is theoretically empty. This is regulated by an adjustable timer. (TR-1, 0-160 seconds). Since the theoretical volume of hopper and charging chamber are known, as well as the total cycle time, this timer has been set at 120 seconds, to theoretically clear the hopper.

Operating experience with type and mix of wastes processed at a particular location will show whether the timer setting should be increased or decreased. (For adjustments see "Trouble Shooting Electric Controls"). The setting of 120 seconds was determined by adding 2 second dwell timer setting to the actual no-load cycle time (extend and retract) of the ram, 20 seconds. The 120 seconds setting allows the ram to make 6 complete cycles to clear the hopper. Note however, that the hopper lid can be opened at any time during cycling in order to add wastes. All motion will stop, timer TR1 is reset and operation can be resumed by closing the lid and depressing the start button.

If the timer has run out and LS1 is tripped by the retracted ram, the compaction cycling will stop and the motor will turn off. Even if the timer times out during the cycle, the ram will continue its cycle until it has returned to fully retracted position (tripping LS1). As the slug builds up in the compaction chamber, the ram will not reach LS3. Maximum force will build up and the ram will exert full force (1950 psi, 46,300 lbs.) on the waste slug. This force can be maintained for a period up to 10 seconds (adjustable timer TR2) in order to achieve the squeezing out of liquids. This timer has been set for 2 seconds.

The swell feature has been added for various reasons. For wet wastes it allows time to squeeze liquids out of the slug and drain away. For both wet and dry wastes, but particularly for the dry, cardboard type wastes, the maintained squeeze at full force has a setting effect, minimizing springback upon retraction of the ram.

Liquids will pass by the wear ring behind the ram face, as well as out by the recess at the bottom of the bulkhead door. Holes in the charging chamber bottom further assist drainage. The ram will retract as the timer TR2 runs out. The above is depicted in steps 2 thru 5 of the Operational Sequence Chart. (O. S. chart).

Repeated charging of the hopper, and repeated cycling will build up the slug to a predetermined size which is determined by the location of LS2. At the time that LS2 is actuated and simultaneously the pressure builds up to maximum; or, if the pressure builds up to maximum before LS2 is tripped, a full size slug is obtained. (Step 6, O. S. chart). At any other time, if pressure builds up after activation of LS2, no full slug size was obtained, and compaction continues.

Upon reaching full slug size, the ram will retract 2 inches, to relieve pressure on the slug and bulkhead door. This is accomplished by timing relay TR3 which allows ram retraction for only about 2 inches (See Step 7, O. S. Chart). At this point light "Compactor full" comes on and a buzzer sounds for a period of time equal to the "squeeze-out" interval. After squeeze-out, buzzer, light and motor will turn off.

The operator now initiates the ejection cycle by pressing the "start" button. The bulkhead gate is opened allowing passage of the slug. This is done by extending the hydraulic gate cylinders, using only the PF1 pump. Solenoid Valve DV1 is activated, initiating the gate opening action (See step 8, O. S. chart).

When the gate is fully opened, LS5 is activated which now initiates the ejection stroke of the ram. The ram will extend beyond the gate pushing the slug into the mated container. Only the low pressure high speed pump is used, except when the override button is used. When the ram reaches LS4, it will retract at full speed (Steps 9 & 10 O. S. chart).

The gate is automatically closed when the ram has fully retracted and trips LS1. At this point the motor may turn off or one or more compaction strokes may occur if TR 1 has not timed out.

It may occasionally happen that the ram stalls during the ejection cycle. This is caused mainly by wastes protruding from the receiving chamber into the hopper. The ram uses the high speed, low pressure pump to eject, and therefore may not have enough force to shear the protruding material. Should this happen, the operator should depress the "Override" button mounted on the side face of the control box. The high pressure pump is cut into the ejection cycle temporarily, shearing the protruding material. When the ram has entered the compaction chamber and trips LS2 relay CR7 interupts the "Override" pushbutton circuit, switching the system back to the low pressure pump. Ejection continues using low pressure thus precluding damage to the container. LS9, physically located just before LS1, resets relay CR7 as the ram retracts.

Each ejection is counted on counter in the control box. This counter can be adjusted. Since each slug is approximately .9cft., a theoretically full container condition is reached after 30 ejections.

The counter has been set for 25 ejections.

It should be noted that the one button "start" starts both the compaction and ejection cycles, depending on slug size status. If no operator were present when buzzer and "Compactor full" are on, the compactor will eject first after the start button is pressed. Should the operator open the hopper, he will find the ram extended, immediately flagging him that ejection is to occur next. There is no objection to charging the hopper at this point.

Note also that in the automatic mode, ejection cannot happen if no container is mated with the compactor (LS8 interlock). The gate will not open, neither can any other compaction occur. Also, if the container is full as determined by the ejection cycle counter, a container will have to be exchanged. The exchange of containers (release and re-activation of LS8) resets the counter and allows ejection and normal subsequent operations to continue.

Due to setting of timer TR1, one or more compaction strokes may occur after completion of ejection cycle, since timer TR1 may not have run out. This will clear the hopper of any waste that may have been left when full slug size was obtained.

In the manual mode, the motor has to be started and stopped separately. The joystick on the controls panel operates the various machine functions in sequence and in single steps. Moving the joystick towards front of the machine will cause ram to extend, moving it towards rear will cause ram retraction. Up opens the gate, down closes the gate. The ram cannot be extended unless gate is open; the gate will not close unless ram is fully retracted. An open hopper lid inactivates the joystick. In the manual mode the compactor utilizes low pressure for ram cycling and high pressure for gate cylinders only.

Accidental activation of joystick is prevented by a built-in catch on the joystick. A ring on the joystick shaft has to be pulled up before joystick can be moved.

The joystick is spring centered. Any initiated ram or gate action will stop if joystick is released at any time during the stroke. Note that the limit switches controlling ends of stroke (ram, gate) will not automatically reverse actions initiated by the joystick. Ends of stroke of ram or gate can be determined by noise as hydraulic fluid is dumped over the relief valves.

Controls.

The control panel contains the following: (See Figure 6)

1. Light - "Motor Run" - Green

2. Light - "Container Full" - Yellow
3. Light - "Compactor Full" - White
4. Light - "Heater On" - Yellow
5. Light - "Oil Hot" - Red
6. Pushbutton - "Motor Start" - Green
7. Pushbutton - "Motor Stop" - Red
8. Selector Switch - Automatic - Manual - Off
9. Selector Switch - Eject or Single (Stroke) - Continuous
10. Selector Switch - Deodorizer on - Off
11. Joystick - Forward - Retract - Open - Close
12. Pushbutton - "Override" - Red

1. Light -"Motor Run" - This light will be lit when motor is running.
2. Light -"Container Full" - Container full light illuminates when number of ejection cycles have reached the preset amount on the counter. This light will extinguish after container exchange.
3. Light -"Compactor Full" - Compactor Full light comes on when full size slug is obtained. It extinguishes automatically after motor stops.
4. Light -"Heater On" - Heater On light will come on when hydraulic fluid temperature is below 65 degrees F. and heater in the hydraulic reservoir is on. When fluid reaches a safe operating temperature the heater and light will turn off.
   NOTE: When this light is on, an interlock prevents operation of the compactor.
5. Light -"Oil Hot" - Oil Hot light indicates too high a hydraulic fluid temperature (160 degrees F.). This condition will cause the compactor to shut down if in operation; or prevent start-up if not in use.
6. Pushbutton -"Motor Start" - This pushbutton in the automatic mode starts: Compaction cycle and ejection cycle; in the manual mode it starts the motor only.
7. Pushbutton -"Motor Stop" - The Motor Stop button stops the motor in both modes. It acts as an emergency stop in both modes. Activation of this button stops all action immediately. Cycling will continue upon restart.
8. Mode Selector Switch - The switch selects operating mode. In the off position the hydraulic fluid heater is still on the line. There is no necessity to turn the selector switch to "off" as the motor stops upon cycle completion. It is suggested that this position be used only for extended shut down periods if deodorizer output is not required.
9. Selector Switch - Eject, Single - Continuous
   In the automatic mode this switch is turned to "continuous" and all actions are as described before. Turning the switch to Eject-Single will result in only one compaction stroke after hopper lid closing and pushing the start button, in effect overriding TR1.

When a full slug size is reached, with the switch on Eject-Single, the slug is ejected by pushing the start button, as described before. However, upon completion of ejection cycle the ram will retract and stop, rather than resume compaction cycling as a function of time remaining on TR1.

NOTE: In the manual mode this switch has to be on "continuous".

10. Deodorizer - Continuous - On - Off

    This switch turns the deodorizing unit on or off. Note that turning the mode selector switch to "off" will turn the deodorizer off. The deodorizer can be left on continuously by keeping Mode Selector Switch on Automatic or Manual and leaving the deodorizer selector switch "on".

11. Joystick - Described before.

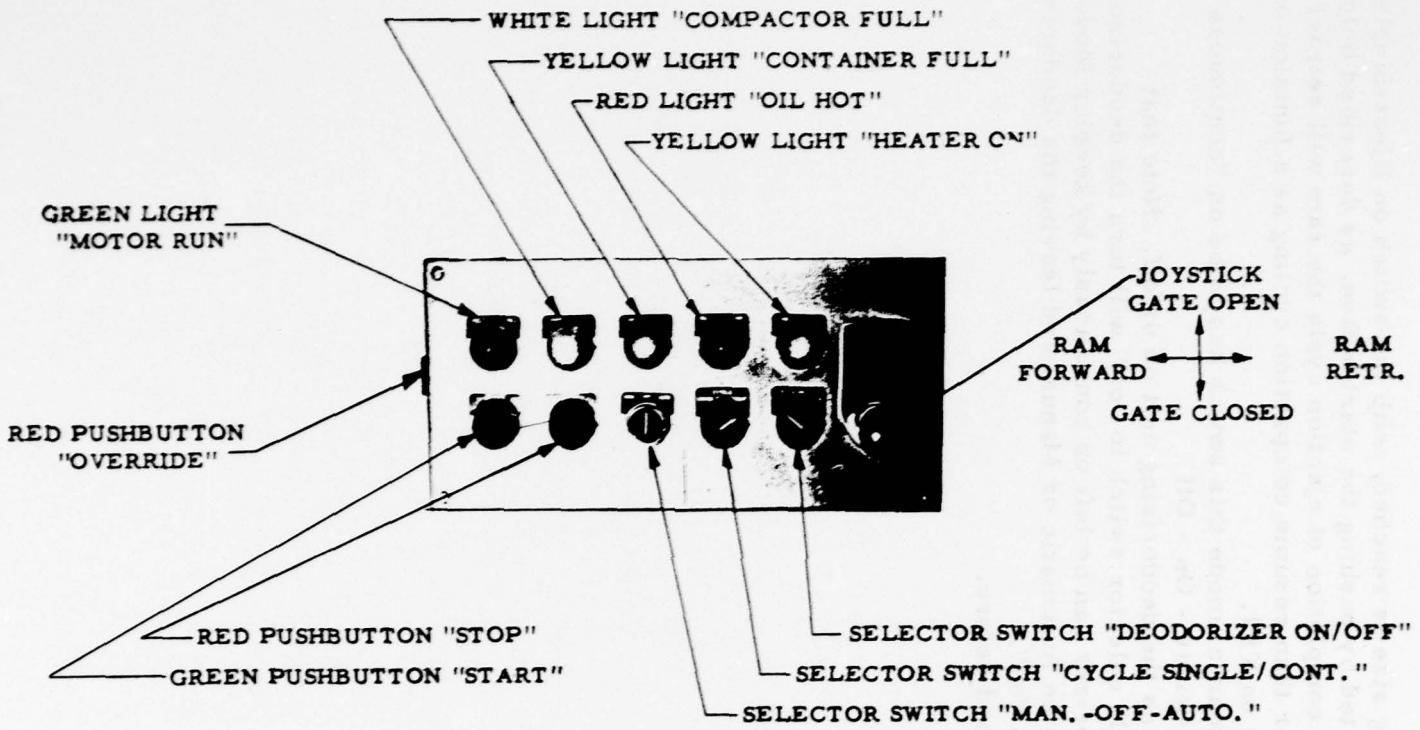


FIG. 6 CONTROL PANEL

Equipment Set-Up

The system can be operated indoors or outdoors. If set outdoors, it is suggested that, as a minimum, a roof is erected to protect the machine from heavy snow accumulations.

The hydraulic reservoir heater is thermostatically controlled and will heat the oil if ambient temperature falls below 65 degrees F.

If the unit is set up in areas, either indoors or outdoors, where the ambient temperatures exceed 125 degrees F., a two-hour continuous duty cycle may cause the hydraulic fluid to overheat (160 degrees F. indicated by "Hot Oil" light). It may then be required to add a cooling coil (water cooling) to the hydraulic reservoir. Provisions (pipe tapped bosses) have been incorporated in the hydraulic reservoir for this addition.

The compactor should be set up on a fairly level hard floor, in order to facilitate container movement. The compactor itself is not sensitive to being out of level. The lower drain pan outlet (4 1/4 inch diameter) should be positioned over a floor drain, or should be hooked up to a drain system.

The compactor base is furnished with one half inch high foot pads with 5/8 dia. holes for bolting to the floor.

The compactor requires a supply of either 200 or 208V, 60 cycle, 3 phase. 4 wire, WYE connected. If any other supply is used, contact the manufacturer. Power requirements are 4500VA. Heater and motor are never on simultaneously.

The user will have to supply a disconnect switch in the power supply line. Power supply entry is on the upper right surface of the control box. Wiring instructions have been included hereafter. A copy has also been furnished inside the control panel door, together with electrical and hydraulic schematic.

A nearby source of water is recommended for washdown of the equipment.

WIRING INSTRUCTIONS COMPACTOR ASSEMBLY

CAUTION
THIS UNIT CAN ONLY BE CONNECTED TO A 4-WIRE, WYE CONNECTED 208 VAC, 3 PHASE, 60 HZ SOURCE.

TO CONNECT ELECTRICAL SERVICE TO THE UNIT THE FOLLOWING PROCEDURE SHOULD BE USED:

1. OPEN SW1 ON THE VERTICAL TERMINAL STRIP (THIRD FROM TOP.)
2. PROVIDE CONNECTION FROM DIS-CONNECT BOX TO COMPACTOR. USE MULTICONNECTOR CABLE OR INDIVIDUAL CONDUCTORS IN A CONDUIT. WIRE SIZE TO BE IN ACCORDANCE WITH LOCAL CODE REQUIREMENTS. (MAXIMUM CURRENT DRAW AT 200V IS 22.2 AMPERES.)
3. RUN CONDUCTOR(S) THROUGH THE ENTRY POINT AT THE TOP OF THE ELECTRICAL ENCLOSURE. A WATERPROOF CONNECTOR MUST BE PROVIDED.
4. CONNECT L1, L2 AND L3 TO THE POINTS SHOWN ON THE "MOTOR STARTER". CONNECT THE NEUTRAL TO THE POINT SHOWN ON TERMINAL STRIP IN THE LOWER RIGHT HAND CORNER OF THE ENCLOSURE. IF A MULTI-CONDUCTOR CABLE IS USED, ALLOW SUFFICIENT LENGTH TO REACH THE "NEUTRAL" CONNECTION POINT. CUT BACK OTHER CONDUCTORS FOR L1, L2 AND L3 TO MINIMIZE SLACK.
5. REMOVE THE ACCESS COVERS ON THE SIDE OPPOSITE THE CONTROL PANEL. TO REMOVE PANELS, RAISE FIRST THEN SWING BOTTOM OUT AND PULL DOWN.
6. PLACE "MANUAL-OFF-AUTO" SELECTOR SWITCH IN "MANUAL".
7. STATION ONE MAN ON FAR SIDE OF COMPACTOR WHERE HE CAN SEE THE MOTOR SHAFT. STATION ONE MAN AT CONTROL PANEL.
8. MOVE SW1 TO THE CLOSED POSITION.
9. CLOSE SWITCH AT CUSTOMER-SUPPLIED DISCONNECT BOX.
10. THE MAN AT THE CONTROL PANEL SHOULD PRESS THE "START" BUTTON. ONCE THE MOTOR HAS STARTED, IMMEDIATELY PRESS "STOP" PUSHBUTTON. THE OTHER MAN SHOULD VERIFY THAT THE MOTOR IS ROTATING IN THE DIRECTION SHOWN BY THE ARROW ON THE COUPLING GUARD. IF NOT, THEN DO THE FOLLOWING:
    A. OPEN SWITCH AT DIS-CONNECT BOX.
    B. EXCHANGE THE TWO CONDUCTORS L2 AND L3.
    C. REPEAT STEPS 9 AND 10.

WIRING INSTRUCTIONS COMPACTOR ASSEMBLY

11. REPLACE ACCESS PANELS
12. THE COMPACTOR IS NOW READY FOR OPERATION.

Operational Instructions

Automatic Cycling.

Turn selector switch to "automatic".

Turn selector switch to "continuous".

Open both container latch levers.

Mate container with compactor by guiding the mating surface into the compactor gate. Make sure container mating flange cover is hinged down.

After positioning of container, latch container to the compactor by moving both latching handles up and inward.

Slide flange cover out of the hose flange, located on top cover of container. Slide the deodorizer hose flange into the receptacle. Turn on deodorizer by appropriate selector switch.

Open the hopper lid by pulling the lid latch away from the hopper. The lid can now be lifted any desired amount. Dump waste into hopper. Avoid inserting large boxes that may cause bridging in the hopper. Pre-crush these.

Close hopper lid (it latches automatically) and pushbutton "start". Compactor will now process and compact.

When compacting chamber is filled, signified by white light: "Compactor full" and a buzzer, push the "start" button again. Compactor will then
a) Raise the gate (opening the compaction chamber).
b) Eject the compacted slug into container.
c) Fully retract ram.
d) Lower the gate, closing the compaction chamber.
e) Resume compaction cycling to clear any debris left in hopper.
f) Stop.

Compacting is resumed by recharging hopper and pushing the "start" button.

After a certain number of ejection cycles the light "Container full" will come on. The filled container should be replaced by an empty one following the steps indicated in the beginning of this section and on the compactor mounted instruction plate.

NOTE:
Testing on this unit has shown that compacted waste may collect near the entering end of the container, occasionally causing a blockage of the closing gate. It is suggested that a simple tool such as a common garden rake be kept handy to move the compacted wastes away from the entering end.

Manual Mode.

The Manual Mode is intended to be used for specific purposes such as cleaning, maintenance and ejection of a waste slug at any time.

To initiate an ejection cycle without having reached a full slug size (for cleaning, maintenance or other purposes) turn mode selector switch to "Manual", keeping the other selector switch on "Continuous" and open the gate by pushing joystick upward. This opens the compaction chamber. Make sure gate opens completely which is signified by increase in noise level. Then push joystick toward front and ram will eject. Reverse actions of the joystick will retract ram. Gate is closed by pushing joystick down.

For cleaning and maintenance purposes, the ram can be extended or retracted any distance by use of joystick, after turning mode selector switch to "Manual" and opening the gate. At all times, make sure that gate is either fully open or closed. A partially opened gate blocks any other action.

Ram can be partially extended and motor turned off.

General Notes.

Note that hopper lid has to be closed and latched. Failure to do so will not allow any other machine functions to occur.

Opening the hopper lid during a cycle will cause any ram or gate action to stop, as motor is turned off and ram cycling is interrupted. After closing the lid, the cycle will resume upon pushing "start" button.

Maintenance

Clean Up.

The equipment is designed to permit complete washdown of all components using water and detergent as required. It is recommended that a hard hose spray not be used directly on electrical equipment.

To clean the compaction chamber, hopper and ram proceed as follows.

Turn mode selector switch to "Manual", and with joystick open the gate. Turn machine off. Remove the container, allowing access to front. Open hopper remove panels and wash down. Close hopper start machine and extend ram partially into charging chamber, using joystick. Turn machine off. Open hopper and clean exposed area of ram. Repeat this procedure until ram is fully extended. Ram face can now be cleaned from front of machine.

To clean areas behind the covers, remove upper rear and upper side covers and proceed with wash down of that area.

The compactor base is raised 1/2 inch off the floor to allow for hosing out dirt below the compactor.

Drain pans can be hosed down at any time.

Preventive Maintenance.

Periodically, as a function of usage, grease the following areas using bearing grease or equal.

- Front gate using the two grease nipples provided below the upper gate guard, hopper side

Oil the following areas, using lightweight lubricating oil:

- The roller shafts of limit switches that have rollers.
- Container latch handle pivot points.
- Hopper lid latch and hinge.

On a daily basis check the filter indicator on top of the hydraulic filter. Remove the upper screen guard at the operator side, lift of the control box by lifting the screen until bottom of screen clears. Screen is then tilted bottom out and down to remove.

Observe indicator on top of filter housing. If a colored indicator is showing, the filter is clogged and should be replaced.

To replace the filter proceed as follows:

- Place a shallow pan below the filter housing.
- Remove drain plug from bottom of filter housing and drain.
- Remove bottom half of filter housing by removing four bolts from the flange.
- Drop bottom half and replace filter (Use York Industries, Inc. P/N 9-30011-2).
- Remount all components in reverse order.
  NOTE - Do not neglect to retighten drain plug.

On a monthly basis check oil level. An oil level gauge is mounted on the hydraulic reservoir, operator side. Gauge sight glass should be full.

If additional oil is required, fill reservoir using filler cap mounted on the reservoir below the hopper hinge. Use Mobile DTE light hydraulic fluid or equal.

Deodorizer.

The deodorizer unit is equipped with a suction inlet filter. If the system is in continuous use, defined as 8 hours/day, 7 days/week, the filter should be replaced monthly. Less frequent usage allows for longer exchange intervals, in direct ratio.

To replace filter, push the flange on the bottom surface of the deodorizer sideways toward overload button. After one side of flange is freed, tilt flange out of guide and remove with the L-shaped filter.

Exchange filter and replace assembly, making sure flange is seated properly.

Use replacement filter P/N 9-30015-1.

Trouble Shooting Guide

1. Start conditions for compacting.
2. Start conditions for Manual Operation.
3. Operating Adjustments.
4. Trouble shooting electric controls.
5. Trouble shooting hydraulic controls.

1. Start Conditions for Compaction (Automatic Operation)

a) Main power on.
b) Mode selector switch in automatic.
c) Cycle selector switch in continuous or single.
d) Ram fully retracted.
e) Gate closed.
f) Lid closed.
g) Container in place and latches closed. (Make sure container is not full.)
h) Deodorizer on. (Optional)

2. Start Conditions for Manual Operation.

Used for cleanout, maintenance or eject between cycles.

a) Main power on.
b) Mode selector switch in manual.
c) Cycle selector switch in continuous.
d) Ram fully retracted to open or close gate.
e) Gate fully open to move ram.
f) Container in place and latches closed. (Make sure container is not full).

NOTES:

Ram and gate, in automatic as well as in manual mode, will not start immediately. A timer (TR1) allows for a "no load" start up of the motor.

In single cycle operation (compaction or ejection) keep start button depressed until ram starts or motor will stop.

3. Operating Adjustments

Compaction rate too low or too high.	Observe gages on hydraulic manifold while machine is operating. (Make sure shut off valves on manifold are open). Adjust relief valves RV1 and RV2 & pressure switches PS1 and PS2 to desired setting but do not go over: Low Pressure 550 psi High Pressure 2,200 psi
Dwell time too long or too short.	Adjust TR2 to desired setting. See section 4 under "Timer".
Cycle time too long or too short.	Adjust Cam on TR1 to desired setting. See section 4 under "Timer". Timer limits 0-160 seconds.
Container over - or underfilled.	The number of ejection cycles is limited by the setting of the counter (inside control box, mounted on the door). To make sure counter works properly: a) Do not remove and replace half-filled containers. b) Open gate only once for each ejection cycle. c) Eject only full size slugs. Maximum recommended setting: 25
Ram retracts too much or not enough after full slug is obtained.	The amount the ram retracts for pressure relief is governed by TR3. For adjustment see section 4 under "Timer". Caution: Retract ram the minimum amount necessary in order to prevent uncompacted trash from falling in front of ram.
Hopper is not empty after machine shuts off.	Trash hangs up in hopper. Make sure selector switch for cycle mode is in continuous. Make sure cycle time is adjusted properly. See if container is in place and not full.
Gate does not close completely.	a) Trash jammed in gate. Remove obstacles. This can often be done by opening & closing gate several times in manual mode, or using a rake as suggested in "Operating Instructions, Auto. Cycle".

3. Operating Adjustments (Cont.)

Gate does not close completely. (Cont.)	b) Container is overfilled.	Exchange containers.
	c) LS1 is out of adjustment.	Adjust.
	d) LS6 is out of adjustment.	Adjust.

4. Trouble Shooting Electric Controls

Work this Guide With Electrical Schematic 6-1-5602

Trouble	Possible Cause	Remedy
Motor does not start in manual mode. (See starting conditions first).	a) Oil Hot (See also "System Overheats").	Wait until "OIL HOT" light goes off.
	b) Switch SW1 open (inside control box).	Close switch.
	c) Fuse FU2 burned out.	Replace fuse.
	d) Motor overload tripped.	See starter.
	e) Timer TR1 out of adjustment.	Readjust cam of TR1 to be closed when in start position.
	f) Fuse FU1 burned out.	Replace fuse.
	g) Reservoir heater on.	Wait until heater goes off.
Motor does not start in automatic mode. (See starting conditions first).	a) Motor overload tripped.	(See starter.)
	b) Switch SW1 open (inside control box).	Close switch.
	c) Fuse FU2 burned out.	Replace fuse.
	d) Oil Hot (See also system overheats).	Wait until light "OIL HOT" goes off.
	e) LS7 out of adjustment.	Open hopper lid. Remove cover of LS7; bring lid down to an opening in front of 1/2" or less. Adjust lever by means of Set Screw to trip LS7 at this point. Close lid completely, check overtravel of LS7. Replace cover.
	f) Fuse FU1 burned out.	Replace fuse.
	g) Reservoir heater on.	Wait until heater goes off.

4. Trouble Shooting Electric Controls (Cont.)

Trouble	Possible Cause	Remedy
Compactor does not stop after preset cycle time.	LS1 or LS6 out of adjustment.	Readjust, see "Limit Switches."
	TR1 misadjusted or defective.	Readjust or replace.
Motor starts but ram does not move.	TR1 misadjusted or defective.	Readjust or replace.
	LS1 or LS6 out of adjustment.	Readjust. See "Limit Switches".
Ram does not retract when LS3 is reached.	LS3 out of adjustment.	Readjust, see "Limit Switches".
	LS6 out of adjustment.	Readjust, see "Limit Switches".
	CR2 defective.	Replace.
	Ram directional valve does not shift.	See "Valves".
Ram ejects but does not retract.	LS4 out of adjustment.	Readjust LS4. See "Limit Switches".
	CR2 defective.	Replace.
	Ram directional valve does not shift.	See "Valves".
Gate does not open when in eject cycle.	TR1 defective.	Replace.
	LS8 out of adjustment.	Readjust LS8. See "Limit Switches".
	CR1 defective.	Replace CR1.
	Gate directional valve does not shift.	See "Valves".
Gate does not close after ram retracts.	TR1 defective.	Replace.
	LS8 out of adjustment.	Readjust LS8. See "Limit Switches".
	CR1 defective.	Replace.
	LS6 out of adjustment.	Readjust LS6. See "Limit Switches".

4. Trouble Shooting Electric Controls (Cont.)

Trouble	Possible Cause	Remedy
Gate does not close after ram retracts. (Cont.)	CR3 defective.	Replace.
	Gate directional valve does not shift.	See "Valves".
	LS1 out of adjustment.	Readjust LS1. See "Limit Switches".
	Also See Section 3.	
Light "HEATER ON" stays on and fluid does not come up to temperature.	Loose connections to heater.	Retighten.
	Heater burned out.	Replace.
Ram compacts but does not retract.	PS1 out of adjustment.	Readjust PS1. See "Operating Adjustments" for settings.
	PS1 defective.	Replace.
Ram does not release pressure after full slug size is reached.	TR2 defective.	Replace.
	LS6 out of adjustment.	Readjust LS6. See "Limit Switches".
	PS1 out of adjustment.	Readjust PS1.
	PS1 defective.	Replace.
	LS1 out of adjustment.	Readjust LS1. See "Limit Switches".
	CR6 defective.	Replace.
	LS2 out of adjustment.	Readjust LS2. See "Limit Switches".
	CR5 defective.	Replace.

Limit Switches: When readjusting limit switches make sure switch does not bottom out when completely depressed by Cam. If protective bellows around stem is found to be cracked, replace. After adjusting make sure all screws are tight. (Some screws are underneath "plug-in" part of the switch).

After switch is released make sure it returns to its start position without binding. If switch is found to be defective, replace "plug-in" part of the switch.

Heater: If heater burns out, turn off main power. Drain hydraulic reservoir, replace heater. After filling hydraulic reservoir check for leaks around heater.

Temperature Switch: If temperature switches do not operate properly, adjust settings as follows:

- Remove sheet metal cover.
- Adjust appropriate dial to the desired position.
- Replace cover.

NOTE: Temperature switch can be removed without draining hydraulic reservoir.

Motor Starter: During normal lifetime the starter should not need any maintenance. If overload trips, check all motor lead connections and tighten if necessary. After the cause of the overload is removed reset white overload button (inside control box).

Timer 1: To change timing of no load start-up or cycle time, loosen appropriate cam and turn to desired setting. Lock in final position.

Timers 2, 3 & 4: Timers can easily be checked for proper operation by pushing coil to closed position with a small screwdriver. To increase time delay turn adjusting screw clockwise, and to decrease time delay turn counterclockwise.

Relays: With exception of CR1, CR3 & CR7 all relays are "plug-in" type. To replace pull out and replace by new one. Make sure relays are always pushed in all the way.

Counter: To remove "plug-in" type counter, loosen screw at bottom of dial, swing up lever and pull out. After replacing tighten screw.

5. Trouble Shooting Hydraulic Controls

Work With Hydraulic Schematic 6-1-5601.

The hydraulic controls do not need any maintenance except change of filter when clogged (visible at filter sight glass) and change of hydraulic fluid once a year. Use Mobil DTE Light or equal, 35 gallons. Keep oil in hydraulic reservoir at correct level. Make sure breather cap is clean. Check all hydraulic connections for leaks and retighten when necessary. When disassembling hydraulic components take care not to get any dirt in the system.

Trouble	Possible Cause	Remedy
System Overheats:	Not enough oil in reservoir.	Bring oil level to correct point. (Top of sight glass.)
	Ambient temperature too high. (Over 125 degrees F.)	Protect unit from heat or add cooling coil.
	Insufficient cooling.	Add cooling coil in reservoir.
	System pressure too high.	Set to recommended values.
Directional Valves, Pressure Relief Valves, Check Valves:	a) Solenoid burned out.	Replace.
	b) Stuck in one position.	Disassemble. Clean.
	c) Worn out.	Replace.
	d) Leaking fittings.	Tighten.
Cylinders:	a) Leaking seals.	Replace seals.
	b) Worn out.	Replace.
Pumps: Pumps not delivering oil:	a) Wrong direction of pump rotation.	Change sense of rotation. (See arrow on coupling cover.)
	b) Oil level too low in reservoir.	Add oil to correct level. (Top of sight glass.)
	c) Air leak in suction line.	Tighten joints.
	d) Suction line or strainer plugged.	Clean out.

5. Trouble Shooting Hydraulic Controls (Cont.)

Trouble	Possible Cause	Remedy
Pumps not delivering pressure:	a) Dirt or chips in pump.	Dismantle pump and clean.
	b) Pressure relief valve not adjusted - or not working right.	See under "Valves".

Deodorizer:

The unit is equipped with a thermal overload located underneath the box. In case it trips, investigate and clear up cause of overload and reset.

Trouble	Possible Cause	Remedy
Deodorizer does not run.	a) No electric power to control box.	Turn on main switch.
	b) Switch SW1 inside control box open.	Close switch.
	c) Mode Selector Switch in off position.	Turn to manual or automatic.
	d) Deodorizer Switch in off position.	Turn switch to on.
	e) Hydraulic fluid heater on.	Wait until fluid reaches correct temperature.
	f) Fuse FU2 burned out.	Replace fuse.
	g) Deodorizer overload is tripped (underneath deodorizer).	Check for reason of overload. Reset overload pushbutton.
	h) Fan motor burned out.	Replace
	i) Deodorizer defective.	Replace deodorizer.

Adjustment of Relief Valves and Pressure Switches.

The following section deals with the adjustment of the pressure relief valves RV1 and RV2 and the pressure switches PS1 and PS2. To accomplish any adjustment of these elements, it is necessary that the access covers at the rear of the unit be removed allowing complete access to the Manifold Assembly and the pressure switches PS1 and PS2.

CAUTION

THE ADJUSTMENTS DESCRIBED BELOW SHOULD ONLY BE PERFORMED BY SUPERVISORY PERSONNEL WHO ARE THOROUGLY FAMILIAR WITH THE DETAIL OPERATION OF THE WASTE DISPOSAL UNIT.

The pressure switch setting should always be approximately 50 psi below the setting of the appropriate relief valve.

CAUTION

MAXIMUM SETTING RV1 2200 PSI
MAXIMUM SETTING RV2 550 PSI

At the beginning of each of these procedures, it is assumed that the unit is in a Normal "STOP" condition:

- Hopper Lid Closed
- Ram fully Retracted
- Gate Closed
- Container in Place.

Relief Valve Adjustment.

If either relief valve needs adjustment, proceed as follows:

1) Place selector switch, SSW1 in "MANUAL".
2) Push "START" push button.
3) Manually operate mechanical over-ride on solenoid section of relief valve. Observe pressure shown on gauge. (PG1 or PG2 for RV1; PG2 for RV2.)
4) To release pressure, move joystick briefly to "RETRACT".
5) Remove screw securing the protective cover.
6) Remove protective cover.
7) Loosen hex lock nut on adjusting screw.
8) Turn adjusting screw clockwise to increase pressure, counter-clockwise to reduce pressure. NOTE: The socket on the end of the adjusting screw is for a 6 mm hex key. If none is available, a 7/32 inch key can be used.
9) To verify pressure, follow steps 3 and 4 above.

Relief Valve Adjustment. (Cont.)

10) After obtaining desired pressure, hold adjusting screw in place with hex key and tighten hex lock lock nut.
11) Replace protective cover and screw.

Adjustment - Pressure Switch, PS1.

1) Place Selector Switch SSW1 in "MANUAL".
2) Push "START" push button.
3) Using Joystick, open gate and stroke ram to fully extended position.
4) Loosen screws holding cover plate of pressure switch, PS1. CAUTION: DO NOT REMOVE SCREWS FROM PLATE. Screws are captive-type; five to seven turns are sufficient to permit removal of plate.
5) Place leads of Ohm meter across conductors 39 and 41 in the Pressure Switch case.
   NOTE: The conductors are open and will show continuity when the pressure switch is operated.
6) Manually operate the RV1 over-ride and the over-ride on Solenoid B of the directional valve DV2.
7) By observing pressure gauge PG1 and the Ohm meter determine the operating pressure of PS1.
8) To release pressure, move the Joystick momentarily to the "RETRACT" position.
   CAUTION: REMOVE OHM METER LEADS BEFORE ANY NORMAL OPERATION USING CONTROL PANEL.
9) To change setting of the pressure switch, turn the adjusting wheel as indicated by the dical inside the case.
10) To verify the new setting, follow steps 5 thru 8 above. Repeat as necessary.
11) After obtaining desired setting, replace cover.
12) Move ram to fully retracted position using Joystick.
13) Close Gate.

Adjustment - Pressure Switch, PS2.

1) Place Selector Switch SSW1 in "MANUAL".
2) Push "START" push button.
3) Remove cover of pressure switch. (See step 4 on PS1.)
4) Place leads of Ohm meter across conductors 62 and 63.
   NOTE: These conductors will show continuity normally and will open when the pressure switch is operated.
5) Manually operate the over-ride on the solenoid of RV2.
6) By observing the pressure gauge, PG1 and the Ohm meter, determine the operating pressure of PS2.
7) To relieve the pressure, momentarily operate the Joystick to extend then retract.

Adjustment - Pressure Switch, PS2. (Cont.)

CAUTION

REMOVE OHM METER LEADS BEFORE ANY NORMAL OPERATION USING CONTROL PANEL.

8) To change the setting of the pressure switch, turn the adjusting wheel as indicated by the decal inside the case.
9) To verify the new setting, follow steps 4 through 8 above. Repeat as necessary.
10) After obtaining desired setting, replace cover.

On completing the desired adjustments, replace all access covers.

Recommended Spares.

The following spares are recommended:

Description	Part Number	Vendor Code Identification	Quantity
Hydraulic Filter Element	9-30011-2	81616	2
Limit Switch	802T-KTP1	01121	1
Limit Switch	802T-DTP	01121	1
Limit Switch	802T-DP	01121	1
Contact Block	10250T-2	27191	1
Time Delay Relay	10337H278-39EO	27191	1
Relay 8-Pin	KAP11AG120V	12300	1
Indicating Light	10250T201	27191	1
Lamp	656-120	27191	2
Suction Filter, Deodorizer	9-30015-1	81616	2

For replacement of hydraulic ram actuator seals use:
Seal Kit - P/N 2-60077-100 Code Ident.: 81616

TEST REPORT

Functional Test of
Waste Disposal System
developed for
U. S. Army Natick Laboratories
under
Contract No. DAAK03-74-C-0106

York Industries, Inc.
York County Industrial Park
P.O. Box 127
Emigsville, PA 17318

Peter J. Hoet

45328

The test was held on December 10, 1974 at York Industries, Inc. Plant, Emigsville, Pennsylvania.

Present for Natick Laboratories were Messrs. Leo Harlow and James Nibi.

York Industries, Inc. personnel involved were Messrs. Peter J. Hoet, Leon Kerger, Richard Vishe and William Sprenkle.

The functional test was performed in accordance with the requirements of the contract, section 3. Appropriate paragraphs of this section have been excerpted as follows:

Requirements:

a. The waste disposal unit shall process 600 lbs. of mixed waste per hour consisting of the following materials with a minimum volume reduction of 4 to 1:

(1)	Animal and vegetable, edible and non-edible	300 lbs.
(2)	Paper, paperboard, napkins, fiberboard, etc. . . .	100 lbs.
(3)	Metal cans, 28 gage and lighter, strapping, etc. . .	50 lbs.
(4)	Wood, small crates, etc.	50 lbs.
(5)	Glass, jars, bottles, etc.	75 lbs.
(6)	Plastics, cups, wrappings, etc.	20 lbs.
(7)	Other (Material not indicated above)	5 lbs.

The unit shall be capable of processing this mix by utilizing a maximum of two input openings of sufficient size properly identified for intended materials. In addition to processing the mix as referenced above, it shall satisfactorily process individual loads of 100 lbs. of pure garbage, including medium size bones, 20 each No. 10 cans, 20 lbs. mixture of 1 gal. jars and 1 qt. bottles and 100 lbs. mixture of wood, paper and plastic films. All mixed and individual load wastes shall be processed without jamming, clogging or causing undue strain on equipment.

During the inspection and demonstration period the equipment components and their functions were explained, examined and demonstrated. Various comments by Messrs. J. Nibi and L. Harlow are reproduced below. The equipment was dry run in automatic and manual modes.

The processing of mixed waste started at 2 p.m. The waste used were obtained from institutions, school cafeterias and private homes.

The empty container was weighed at 300 lbs. The test lasted for 58 minutes, excluding a 7 minute break for adjustment of the limit switch that limits the ram travel during ejection. The switch was adjusted to give a longer stroke.

The container was weighed again. A total of 508 lbs. of compacted waste was processed. It was judged that approximately 20 - 25 lbs. of liquid and

slurry waste had been eliminated during the compaction process.

The 500 lbs. of waste processed required 7 ejections into the container. A total of 42 plastic bags, averaging 1 to 1.5 cubic feet were compacted to seven slugs averaging .9 cubic feet in size, so that the compaction rate achieved was approximately (42 x 1.25) : (7 x .9), or 52.5 : 6.3 or 8.3 to 1, exceeding the minimum 4:1 ratio required by specification.

This volume of waste filled the container approximately 85%, including voids. The reason for filling the nominal 1 cubic yard container to that extent is the springback in the waste when ejected. Due to the fact that a large amount of moisture is removed from the waste during compaction, the residue is fairly dry. Upon ejection the waste slug falls apart, creating voids.

At one point during the one-hour test, a jam-up occured during the ejection cycle. Upon investigation it was found that a bundle of heavy magazines protruded into the hopper area. Since the ram operates with low hydraulic pressure during ejection stroke, not enough force was available to shear this bundle. The operation was switched to manual, ram was retracted, magazine bundle was pushed down and the slug was ejected.

The moisture removal feature of the equipment functioned as designed. Liquids and slurry escaped both by the guillotine door and past the ram wear ring and were wiped out the back of the receiving chamber upon return stroke of the ram. At one point during the test a large volume of liquid and slurry was eliminated in a short time interval resulting in overflow of drain pans. However, the equipment does successfully remove large amount of liquids. In subsequent test a volume of tin cans of sizes larger than #10 cans thru soda cans were processed.

A volume of about 4 cubic feet of cans was reduced to a slug of 14 inch diameter by 3 inch thick (.27 cubic foot) for a reduction ratio of 14.8:1.

Messrs. Nibi and Harlow dispensed with the other tests (glass crushing, wood, etc.) as unnecessary based upon equipment capability shown during the one hour test.

In discussion of the test results it was agreed by Messrs. Harlow and Nibi that the equipment reduces the volume of wastes by at least 4 : 1; that liquids are successfully eliminated; and that the equipment can process the specified wastes and refuse without undue strain or damage.

It was also noted that the drainage system could be improved and that front gate guards should have been removable for easier cleaning.

The following are the comments noted by Natick representatives:

1. Add simple operational instruction plate near the operator console.
2. Add warning plate "Do not operate without container in place."

3. Add positive stop at maximum allowable position of LS3 to prevent an adjustment that would allow ram teeth to contact gate.
4. Label all limit switches, timers and relays, counters, etc. to facilitate maintenance - on timers relays, where applicable, add brief functional description.
5. Label counter : "Do not set over . . . . . ejections."

Items 4 & 5 were implemented the same day. The others are in process.

In addition, some comments were made in regards to improving the liquid waste drainage system. It was agreed that York Industries would propose improvements separately for evaluation, prior to any implementation. Also, it was requested that York Industries look into improving sealing and cleanliness around front gate, and the possibility of ejecting under high pressure.

Conclusions:

The system as designed and built exceeded the minimum specified requirements. Tests showed that volume reduction of mixed wastes was better than 8 : 1. Reduction of other materials such as tin cans, amounted to over 14 : 1.

Liquids and mushy contents were squeezed out and evacuated from the compactor into the drain pans.

Waste slugs consisted of dense, fairly dry mass that breaks up when ejected into the container.

Including the weight of eliminated liquids and slurry, about 540 lbs. of garbage were processed in 58 minutes. A higher rate can be attained if wastes are deposited loose into the hopper, rather than in big bulky plastic bags which were used during the test and because of bridging in the hopper, adversely affected the thru-put rate.

Glass and hard plastics were pulverized, steel and aluminum cans of various sizes were reduced to a dense slug. Various 2 x 4 softwood pieces were sheared in one stroke and then subsequently reduced to splinters. A 2 x 4 x 12 laid flat on the bottom of the compaction chamber (length in direction of stroke) is splintered. The compactor's ruggedness was further tested by laying a 4 x 4 x 6 inch oak block in the bottom of the compaction chamber. The full force of the ram was repeatedly exerted on the 4 x 4 block causing a substantial moment (over 220, 000 inch lbs.) on the ram structure and its supporting structure.

No failures or permanent distortions were evident.

Certain aspects of the machine can be improved. The desirability of these improvements were not evident until testing had been accomplished.

These areas are:

- Ram stalling during ejection. (Ejection is done using low hydraulic pressure to prevent damage to container.)
- Drainage System - Sudden heavy concentrations of slurry type liquids can overtax the present drainage system.
- Addition of seals and deflectors to direct liquids into drainage system.
- Change in front (gate) guards to facilitate cleaning. These guards are made from expanded and sheet metal and are fixed for personnel safety reasons.

These improvements, if incorporated during the current or a subsequent program, would enhance the overall efficiency of the equipment.

After modifications and improvements were incorporated the compactor was tested again on January 20, 1976. The entire unit was thoroughly inspected by the Natick Laboratories Representative. Approximately 500 lbs. of house type wastes were compacted. Water was added to test the drainage system capacity. The holes added to the bottom of the charging chamber and the drain relief near the bottom of the compaction chamber at the gate were found to be effective. No fluids were observed passing by any other areas of the gate proving adequacy of the seals that were added. Drain pans proved adequate in catching and containing liquids and small particulate matter. No overflow was observed, nor did any exiting matter fall outside the drainage system.

The override button was tested and found to clear jamming conditions during ejection mode. The safeties incorporated with the override button were tested.

Small leaks were found to exist between hopper and charging chamber flange; through the stationary shear blade mounting bolts and in the drain pan transition area. These conditions were corrected and tested prior to shipment.

Shipment to Natick Laboratories was authorized by the Natick representative upon correction of the discrepancies noted above.